



**U.S. DEPARTMENT OF
ENERGY**

Hydrogen from Coal Program Overview and Accomplishments

Dr. Lowell Miller

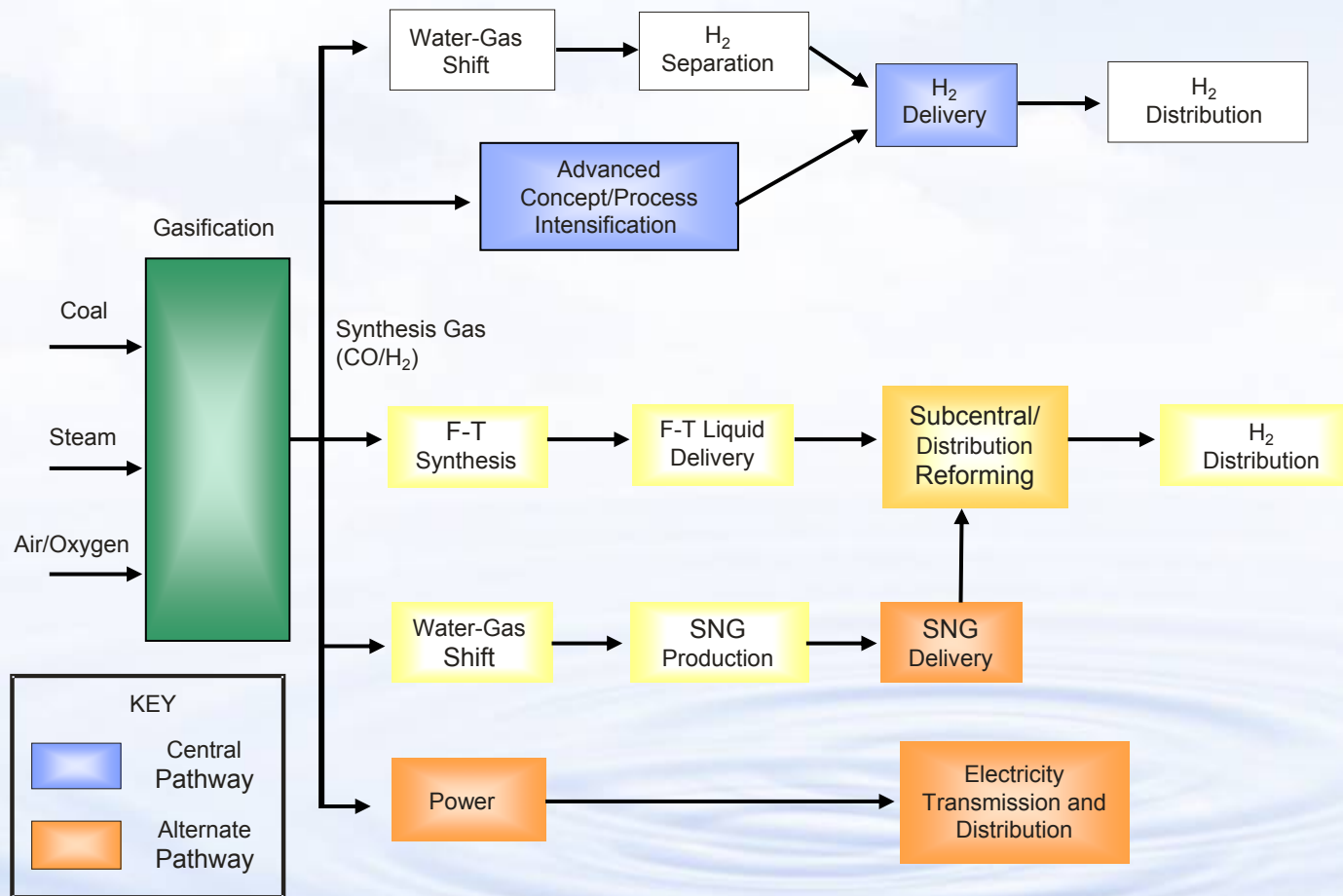
**Director, Office of Sequestration, Hydrogen,
and Clean Coal Fuels**

U.S. Department of Energy

**2006 DOE Hydrogen Program
Merit Review and Peer Evaluation Meeting**

May 16, 2006

Hydrogen from Coal Pathways



Hydrogen from Coal: Technology Challenges

● Reduce the cost/improve efficiency

→ Clean synthesis gas production

- Advanced gasification
- Oxygen production
- Advanced gas cleaning

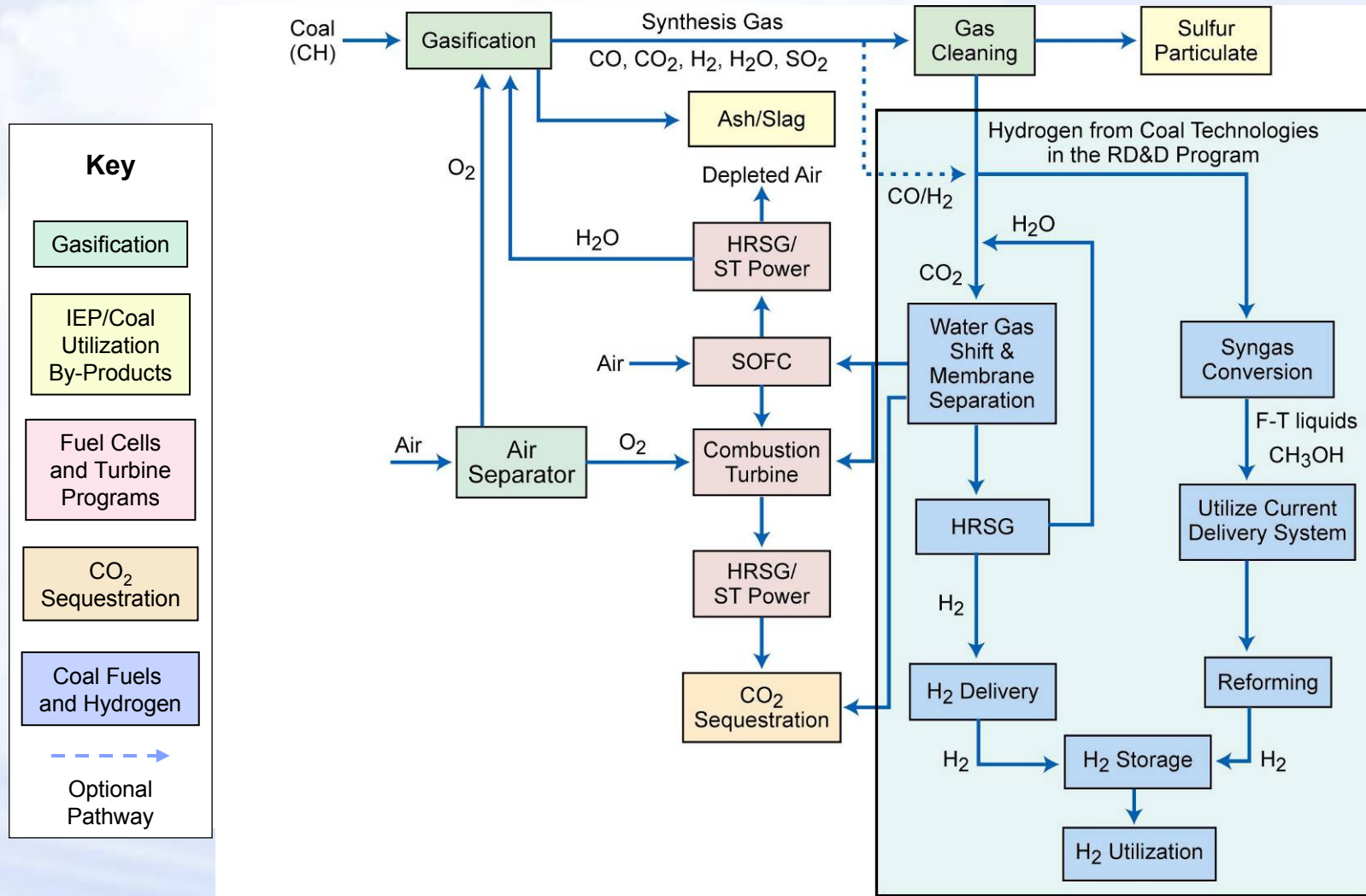
→ Hydrogen separation & purification

→ Process intensification

● Capture and store carbon

● Integrate technologies into FutureGen

Hydrogen from Coal: Technology



Hydrogen from Coal: Research Areas

Research Area*	Number of Projects
Membrane research	6
Module scale-up	1
Membrane reactors & process intensification	7
CO ₂ removal	1
Novel sorbent	1
Co-production	4
Liquid H ₂ carriers	4
Storage	3
Utilization	5
TOTAL	32

** Complementary projects are supported by the Gasification and Sequestration Programs*

FY 2007 Budget Request \$22.1 M
FY 2006 Appropriation \$ 28.7 M
FY 2005 Appropriation \$ 17.0 M

Hydrogen From Coal: Goal

Facilitate the transition to a sustainable hydrogen economy through the use of coal, our largest domestic fossil resource

Objectives

● *Production: Central Pathway*

- ➔ By 2015, demonstrate a 60% efficient, zero-emission, coal-fueled hydrogen and power co-production facility that reduces the cost of hydrogen by 25% compared to current coal-based technology.

● *Production: Alternative Hydrocarbon Pathway*

- ➔ By 2011, an alternative hydrocarbon pathway and reforming system for sub-central/decentralized hydrogen from coal is available.

FY2005 Accomplishments

- **Completed update of the Hydrogen from Coal RD&D Plan – September 2005**
- **Sampling of Project Accomplishments**
 - ➔ **Media and Process Technology, Inc.: H₂ Production via a Commercially-Ready Inorganic Membrane Reactor**
 - 100-hour field test of a carbon sieve-based membrane
 - Showed excellent H₂ selectivity and permeance in presence of H₂S, NH₃, and hydrocarbons
 - Can potentially combine WGS, separation, CO₂ capture, and contaminant removal in single step
 - Mathematical model developed is consistent w/experimental data

FY2005 Accomplishments (cont.)

● Sampling of Project Accomplishments (cont.)

→ Siemens Power Corp.: Novel Gas Cleaning and Conditioning for IGCC

- 10 tons/day pilot plant test at Gas Tech. Inst.
- Pre-combustion gas-cleaning concept
- Reduced contaminant levels to 10-50 parts per billion by volume

→ NETL: Novel Hydrocarbon Reforming Catalyst for Synthesis Gas Production

- Demonstrated exceptionally stable performance of a hydrocarbon reforming catalyst
- Catalyst is expected to be more robust and tolerant of carbon and sulfur

FY2006 Activities

● Four new projects awarded in co-production to improve plant economics

→ Research Triangle Institute (H₂-Electricity Co-production)

- Reduction and oxidation of iron-based catalysts to process coal-derived synthesis gas

→ Research Triangle Institute (Substitute Natural Gas (SNG)-Electricity Co-production)

- Pre-processing conversion of coal to gaseous mixture followed by conversion to SNG

→ Arizona Public Service (SNG-Electricity Co-production)

- Utilizing hydro-gasification technology

→ West Virginia University Research Corp. (Novel products to improve economics)

- Utilizes small amount of produced hydrogen to co-produce high-value industrial products

FY2006 Activities (cont.)

● Recent Solicitations

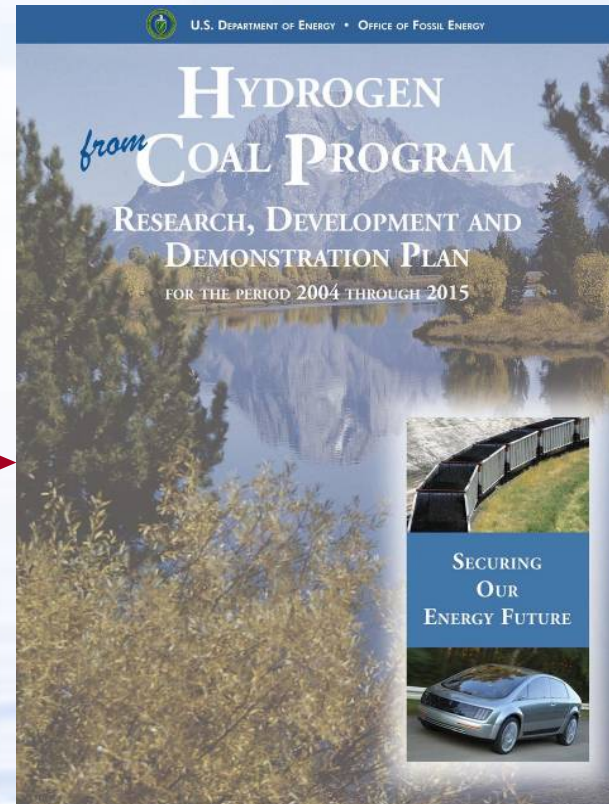
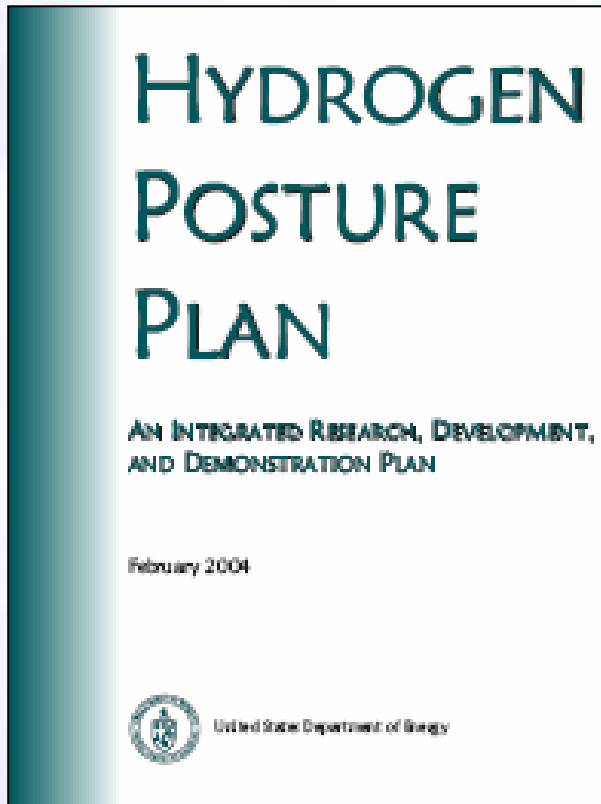
→ Central Production

- Two areas of focus: Novel polishing filters and process intensification
- Closes June 8, 2006

→ Alternate Production and Utilization

- Closed on May 11, 2006

Hydrogen from Coal – Clean, Secure, Affordable Energy for the Future



<http://fossil.energy.gov/programs/fuels/>